Characterization and Observation of Dopants on Nano Quartz Crystal Growth

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Introduction

Nano silica particles were used as substrates for the deposition of dopant silver nano particles, with the resulting surfaces analyzed using AFM techniques. The introduction of ions in seeded crystal allow a controlled mechanism for which nanocrystal morphologies can be altered. Dopants, such as silver nano particles, provide a means of manipulating crystal growth in a way not seen in nature, useful in many areas of applied research. During this process techniques were refined for further application to the development of antibacterial metal dopants such as copper and lead, perhaps leading to the further development of antibacterial quartz nano-crystals. Controlling the morphologies of nanocrystals provides the foundation for future development of nano-sized materials on modified crystal surfaces. Future applications may result in the methodologies implementation in designing biologically sustainable nanomaterials for use in nanomedicine.

Method

Samples were prepared through the dissolution of silica metal with concentrated sodium hydroxide, and filtered to form a saturated solution of silica particles. 2 mL of the saturated silica solution were then thoroughly mixed with 20 mg of $AgNO_3$. Other nitrate metals were also prepared similarly, and sonicated for 2 hrs. Samples were then dried and excess sodium hydroxide and unreactive salts were removed using nitric acid and centrifuged to remove unreactive ions then washed with water. The prepared samples were each spin coated on a bare silica chips as a substrate. Surface features of the crystals were analyzed using atomic force microscopy (AFM).

Results

Image 1: Prepared samples of metal ions with silica.

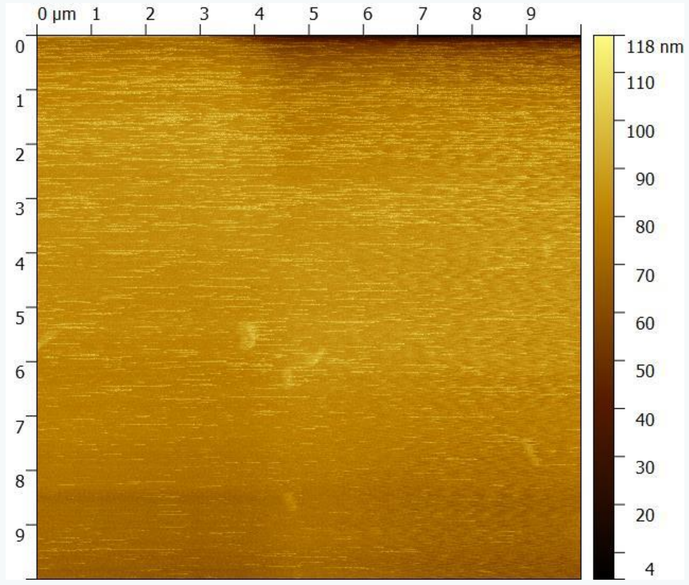


Image 2: Bare silica substrate

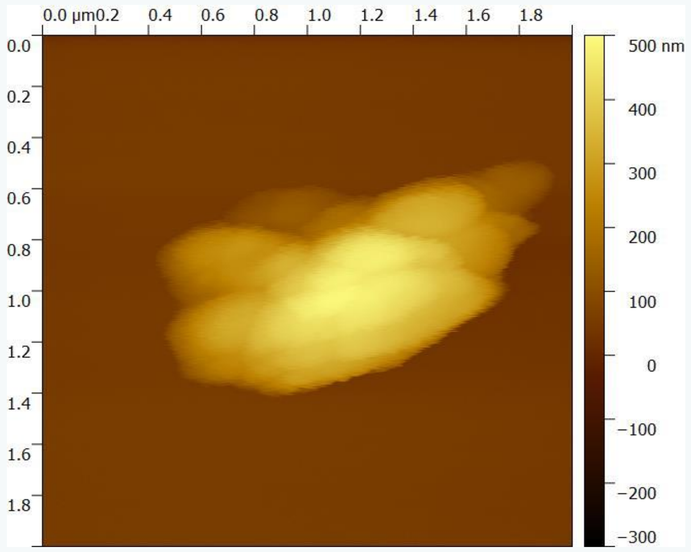


Image 3: Silica particle on bare silica substrate

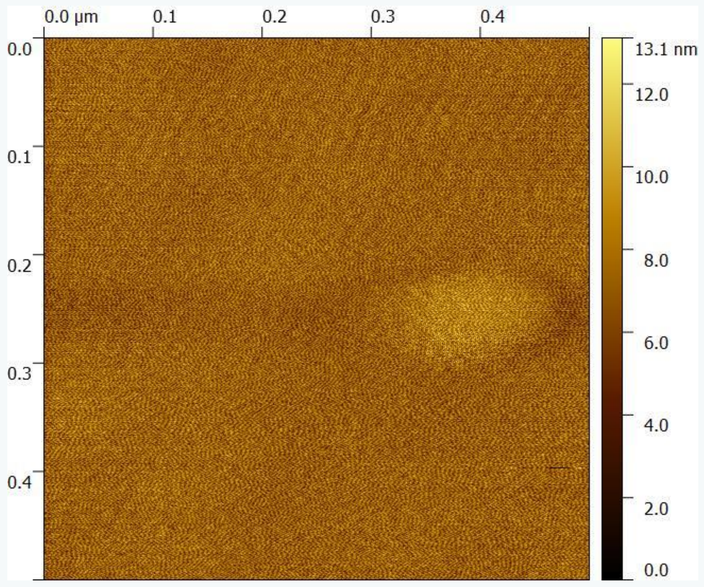
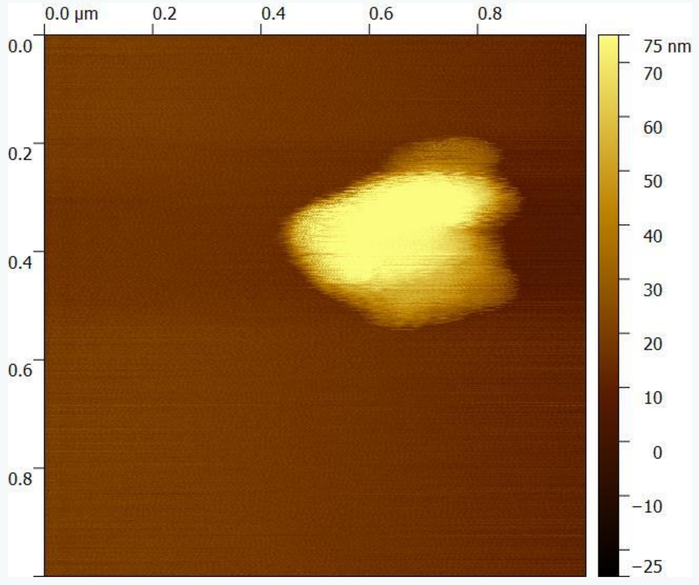


Image 3: Strontium doped silica nano-particle on bare silica substrate



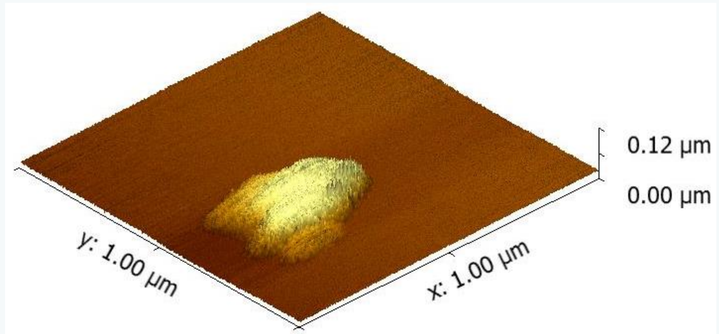


Image 4: Silver doped silica nano-particle on bare silica substrate

Conclusion

The samples prepared and analyzed indicate a change in morphology after analysis using AFM imaging. Further tests are needed to verify the identity of the silica metal samples using elemental analysis, CHNS analysis. Further analysis of the samples can be done using crystallography. Using the techniques used in the preparation of silver particles may provide useful in the formation of copper nanoparticles on silica substrates, for the use in antibacterial biomaterials.

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